



Geotechnical &
Environmental
Consultants

Our ref: 39175/TM

9th July 2019

For the attention of Mr R.Morton

Dear Richard

Re: Cliffe Lane, Gomersal

GeoDyne Ltd has been requested to provide geo-environmental consultancy advice on a parcel of land at Cliffe Lane, Gomersal, Cleckheaton. A site location plan (Figure No. 39175/01) is appended.

PROJECT UNDERSTANDING

The site comprises an irregularly shaped large field to the north of Cliffe Lane and to the south of Ferrand Lane, Gomersal, Cleckheaton.

It is understood that the Client is seeking planning permission for the redevelopment of the site with residential dwellings. Following planning consultation, it is understood that the Coal Authority has objected to the granting of planning permission, as further consideration of historical coal mining activities is required. A copy of the Coal Authority consultation letter is appended.

PREVIOUS WORKS

Previous Phase I desk study works have been undertaken at the site by others, including the following previous report provided to ourselves:

- JPG Report '*Ferrand Lane, Gomersal – Geoenvironmental Desk Study Report*', dated December 2018, Ref: MT/DS/4730.v4.

The JPG desk study indicated the potential presence of historical shallow underground coal mining beneath the site, and identified the presence of two coal shafts within the central-western part of the site.

As part of the JPG works, a Coal Authority mine shaft report was obtained, which provided anticipated Ordnance Survey National Grid Reference Co-ordinates for the two shafts based on evidential information held by the Coal Authority. However, we would note that the draft CIRIA C758 guidance document entitled '*Abandoned Mine Workings*' suggests a departure distance of up to 20m dependant on the source data, therefore these co-ordinates have been taken as indicative only in the absence of corroborating evidence. A plan showing the GPS coordinates of the recorded mineshaft positions is appended.



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The JPG report states *'Records indicate that former mine shafts are located on or close to the site which will require investigation and treatment works. The site may have been subject to shallow mining of coal, which will also require investigation and may require stabilisation works.'*

The Coal Authority also stated in their return letter that *'The Coal Authority expects that intrusive site investigations are undertaken within the application site boundary prior to determination, in order to establish the location and condition of the 2No. mine entries. Findings from these investigations should be used to formulate an appropriate scheme of remediation and to identify appropriate 'no-build' zones around the entries. Revisions to the site layout should then be clearly defined on the site layout plan.'*

We would note that the potential presence of shallow underground workings is not anticipated to represent a technical barrier to development, as any identified workings can be treated by a suitably designed programme of ground stabilisation (i.e. drilling and grouting) undertaken by a specialist Contractor. Such works would be designed following completion of detailed ground investigations, and any shallow workings should not fundamentally affect the proposed site layout (albeit foundation solutions and floor slab designs may be influenced by their presence). GeoDyne would therefore consider that the investigation of shallow historical coal mining beneath the site could be specified as part of a planning condition; as opposed to being required in advance of the securing of planning approval.

However, the presence of mine shafts on the site do represent a potential localised ground stability issue, and therefore further consideration of their presence is considered warranted at a pre-planning approval stage; in order to inform the design/layout of the proposed dwellings.

GEOPHYSICAL SURVEY

In order to investigate the presence and locations of the two indicated on-site shafts, GeoDyne recommended that the Client commission a non-intrusive geophysical survey of the area around the two shafts. GeoDyne discussed the site with a specialist geophysical survey company (Sumo Geophysics) and agreed that a combination of an electromagnetic survey (EM31) and magnetic survey should be undertaken, in the first instance. The adoption of geophysical techniques was also discussed between GeoDyne and the Coal Authority, with the Coal Authority verbally confirming that geophysical surveying techniques are viewed as being an appropriate investigation tool (in the first instance) for the identification of mine shafts at a site.

To inform the geophysical survey, GeoDyne utilised the draft CIRIA C758 document (whilst in draft form, the document is publicly available and is awaiting formal publication; it is therefore considered to represent current industry good practice guidance) and the indicated departure distances to prepare a recommended survey area. The GPS coordinates presented in the JPG report/Coal Authority mine shaft report were used as the starting positions for the survey of the shafts. A 25m survey area from each of the two indicated shafts was adopted for the survey area, which encompasses the likely 20m maximum departure distance indicated by CIRIA C758. The extent of the survey area was therefore designed to be sufficiently large as to pick up any minor deviations in the Coal Authority recorded locations.

GeoDyne attended site during the commencement of the geophysical survey and undertook a walkover of the site. Photographs of the survey area are included as plates. It is noted that the survey area was crossed by a mature hedgerow and existing post and wire boundary fences. Due to the dense nature of several shrubs/trees within the hedgerow, limited access was achievable for the purposes of the geophysical survey. Similarly, the presence of metal (including a discarded trailer which was too heavy to manually remove) resulted in some interference with the survey results (particularly the magnetic survey), however those anomalies are all identified and discussed further in the Sumo report (which should be referred to for more information). A copy of the Sumo report is appended.

The geophysical surveys identified a clear anomalous signature (on both survey techniques) at the location of the most northern shaft (identified as MS-5). The feature appears circular in shape and has been interpreted by Sumo as corresponding to the shaft shown at this location.

Whilst the most southerly shaft appears to be located within the dense hedgerow, given the close correlation between the identified and recorded shaft at MS-5, it is considered that a similar level of geo-referencing accuracy may apply to this second feature (and noting that no anomalous features were identified to the south of the hedgerow in the wider area surveyed).

CONCLUSIONS

On the basis of the works undertaken, the geophysical surveys appear to corroborate the information indicated in the JPG report relating to the position of the mine shafts. Based on the indicated mine shaft locations, JPG has calculated a no-build zone around each of the indicated mine shaft features. A minimum 10m easement from the centre of each shaft has been recommended by JPG (a copy of their correspondence is included herein) and the Client has prepared a revised proposed site layout plan taking account of this easement and identifying a no-build zone (plan also appended). We understand that this information has been prepared to attempt to satisfy the requirements of the Coal Authority, as detailed within their original objection letter.

Whilst it is acknowledged by all parties that detailed exploratory investigation works will be required at the site in due course (including geo-environmental assessments, intrusive investigations at the mine shaft locations and for an assessment of the shallow underground coal mining status of the site), it is considered that such works could be conditioned as part of any planning permission granted for the scheme. The works undertaken to date appear to corroborate Coal Authority information in relation to the two identified shaft locations, and we understand from subsequent conversations with the Coal Authority that where geophysical surveys clearly identify mine shaft locations (as appears to be the case for this site for MS-5), this can be sufficient for their purposes at initial submission and outline approval stage; especially when also taking account of the proposed 'no-build' zone on the amended development plan including a large area of open ground around MS-6.

We would recommend that a copy of this letter and all attached information is formally submitted by the Client to the Local Planning Authority, in order for the Coal Authority to be subsequently formally consulted and to attempt to overcome their initial objection based on the provision of additional information pertaining to the site.

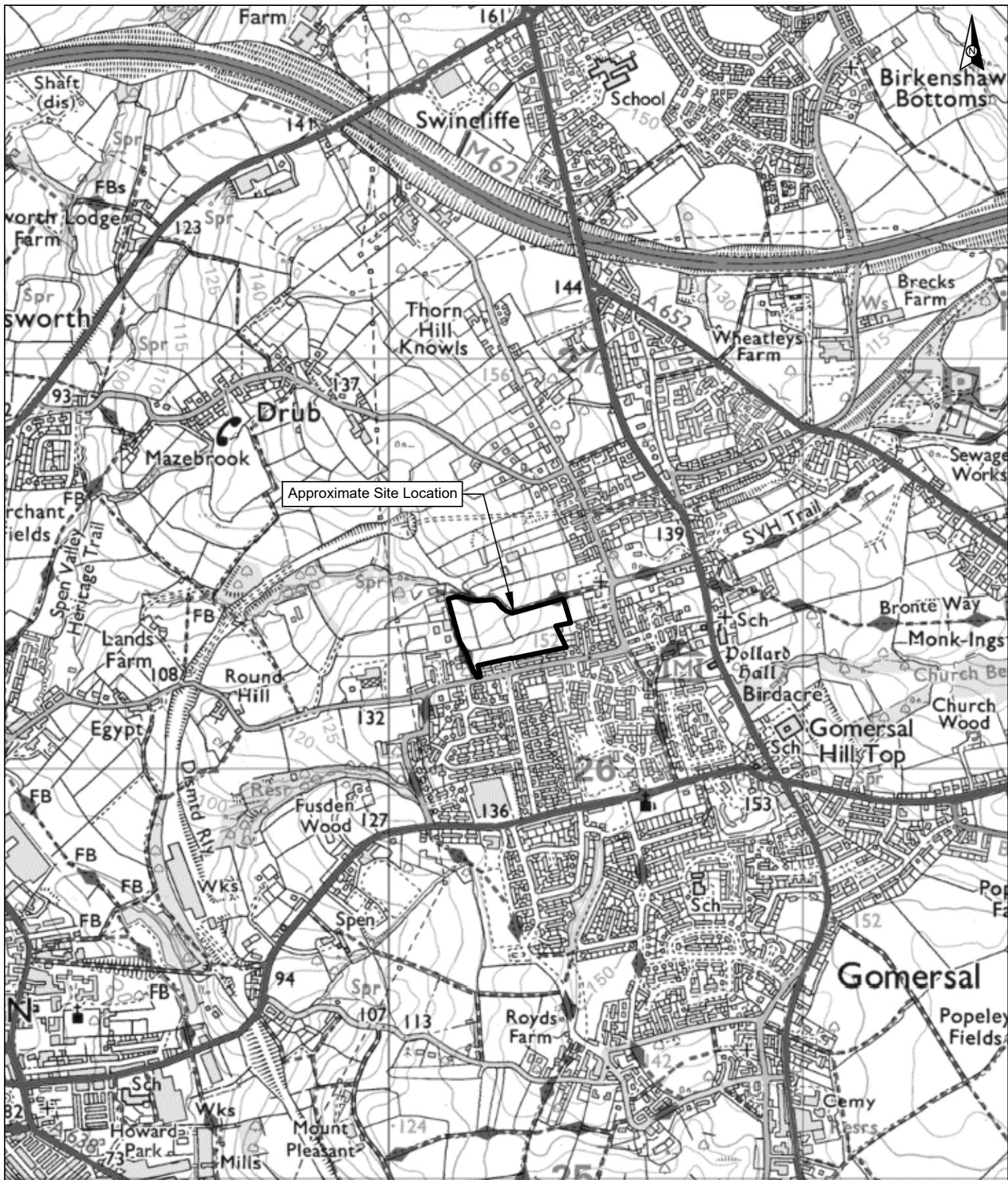
We trust that the foregoing is suitable for your requirements. However, should you have any queries or require any additional information please do not hesitate to contact us.

Yours sincerely

For and on the behalf of GeoDyne Ltd

Tim Milnes
Graduate Geo-Environmental Engineer

Encs. Site Location Plan
Coal Authority Planning Application Letter
Email from JPG Defining 'no-build' Zones
Proposed Layout Plan Including 10m 'no-build' Zones
Indicated Positions of Coal Mine Shafts from the JPG Report
Sumo Geophysics Report for Cliffe Lane, Gomersal.
Plates
Conditions and Limitations



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Project No.	39175	Drawn By	ACH
Client	KCS Development Ltd	Checked By	TM
		Approved By	DH
Project	Cliffe Lane, Gomersal	Scale	NTS
		Date Drawn	08/07/2019
Title	Site Location Plan	Revision	
		Figure No.	39175/01



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For the Attention of: Mr Christopher Carroll – Case Officer
Kirklees Council

[By Email: DC.Admin@kirklees.gov.uk]

16 April 2019

Dear Mr Christopher Carroll

PLANNING APPLICATION: 2019/60/90902/E

Outline application for demolition of dwelling and erection of 92 dwellings; Rear Of, 271 Cliffe Lane, Gomersal, Cleckheaton, Kirklees, BD19 4SB

Thank you for your consultation letter of 27 March 2019 seeking the views of The Coal Authority on the above planning application.

The Coal Authority is a non-departmental public body sponsored by the Department of Business, Energy & Industrial Strategy. As a statutory consultee, The Coal Authority has a duty to respond to planning applications and development plans in order to protect the public and the environment in mining areas.

The Coal Authority Response: Fundamental Concern

I have reviewed the proposals and confirm that the application site falls within the defined Development High Risk Area; therefore within the application site and surrounding area there are coal mining features and hazards which need to be considered in relation to the determination of this planning application.

The applicant has obtained appropriate and up-to-date coal mining information for the proposed development site and has used this information to inform the Geoenvironmental Desk Study Report (JPG, December 2018) which accompanies this planning application.

The report correctly identifies that the application site has been subject to past coal mining related activities. Specifically, the report identifies that the application may have been subject to past unrecorded coal mining at shallow depth beneath the application site and that this requires intrusive site investigations. In addition, the report states stabilisation

works may be required due to shallow workings. The Coal Authority concurs with and welcomes these recommendations.

In addition, the report also correctly identifies that the presence of 2 no. recorded mine entries (420426-005 & 420426-006). The report states that these will “require investigation and treatment works” (page 15). The Coal Authority welcomes this consideration for investigation and remediation of mine entries within the application site boundary. However, I note that having reviewed The Coal Authority records and the submitted proposed site plan (1332 PL101A, Jan 2019) it would appear that the proposed layout has not been informed by the presence of the mine entries. The Coal Authority has a policy where building over or within the influencing distance of a mine entry should wherever possible be avoided. Our adopted policy which can be found at:

www.gov.uk/government/publications/building-on-or-within-the-influencing-distance-of-mine-entries

The 2 no. recorded mine entries pose a significant risk to the safety and stability of the application site and have not informed the layout. This is compounded with the fact that the detailed layout is being determined at this stage and not at reserved matters. Therefore, The Coal Authority **objects** to this planning application.

The Coal Authority expects that intrusive site investigations are undertaken within the application site boundary prior to determination, in order to establish the location and condition of the 2 no. mine entries. Findings from these investigations should be used to formulate an appropriate scheme of remediation and to identify appropriate ‘no-build’ zones around the entries. Revisions to the site layout should then be made in order to ensure that built development avoids the ‘no-build’ zones which should be clearly defined on the site layout plan. This revised layout plan should then be submitted for consideration along with any remediation and mitigatory measures proposed.

It is a requirement of NPPF, paragraphs 178-179, that the applicant demonstrates to the satisfaction of the LPA that the application site is safe, stable and suitable for development.

Had it of been the case that the detailed site layout was being determined at the reserved matters stage, these investigation and remediation works could have been recommended subject to the imposition of a condition(s).

The Coal Authority Recommendation to the LPA

The Coal Authority welcomes the precautionary approach recommended by the author of the report for phases of remediation and investigation. However, it is the opinion of The Coal Authority that the risk and uncertainty is such that further specialist investigation is required before the LPA can be satisfied that the application site can be safely developed.

The applicant should therefore be advised of The Coal Authority’s view and should be required to carry out intrusive site investigation works, subject to obtaining Coal Authority permission, to determine the extent of past coal mining activities and the implications for the layout and design for their development proposal. Any remedial, preventive and

mitigation measures, as necessary, should then be proposed along with a revised layout plan which has clearly defined 'no-build' zones.

Any investigation and remediation works need to be agreed with the Permitting Section of The Coal Authority and should be prepared and conducted by a suitably competent person.

The Coal Authority would be very pleased to receive for further consultation and comment any additional information prepared and submitted by the applicant.

Please do not hesitate to contact me if you would like to discuss this matter further.

Yours Sincerely,

George Weightman

George Weightman | BSc (Hons), MSc
Trainee Planning Liaison Manager

General Information for the Applicant

Where development is proposed over areas of coal and past coal workings at shallow depth, The Coal Authority is of the opinion that applicants should consider wherever possible removing the remnant shallow coal. This will enable the land to be stabilised and treated by a more sustainable method; rather than by attempting to grout fill any voids and consequently unnecessarily sterilising the nation's asset. Prior extraction of surface coal requires an Incidental Coal Agreement from The Coal Authority. Further information can be found at:

<https://www.gov.uk/get-a-licence-for-coal-mining>

Under the Coal Industry Act 1994 any intrusive activities, including initial site investigation boreholes, and/or any subsequent treatment of coal mine workings/coal mine entries for ground stability purposes require the prior written permission of The Coal Authority, since such activities can have serious public health and safety implications. Failure to obtain permission will result in trespass, with the potential for court action. In the event that you are proposing to undertake such work in the Forest of Dean local authority area our permission may not be required; it is recommended that you check with us prior to commencing any works. Application forms for Coal Authority permission and further guidance can be obtained from The Coal Authority's website at:

<https://www.gov.uk/get-a-permit-to-deal-with-a-coal-mine-on-your-property>

Disclaimer

The above consultation response is provided by The Coal Authority as a Statutory Consultee and is based upon the latest available data on the date of the response, and electronic consultation records held by The Coal Authority since 1 April 2013. The comments made are also based upon only the information provided to The Coal Authority

by the Local Planning Authority and/or has been published on the Council's website for consultation purposes in relation to this specific planning application. The views and conclusions contained in this response may be subject to review and amendment by The Coal Authority if additional or new data/information (such as a revised Coal Mining Risk Assessment) is provided by the Local Planning Authority or the Applicant for consultation purposes.

In formulating this response The Coal Authority has taken full account of the professional conclusions reached by the competent person who has prepared the Coal Mining Risk Assessment or other similar report. In the event that any future claim for liability arises in relation to this development The Coal Authority will take full account of the views, conclusions and mitigation previously expressed by the professional advisers for this development in relation to ground conditions and the acceptability of development.

Richard,

Please find attached our updated site investigation specification and proposed exploratory hole location plan which is in accordance with the latest site layout (Ellis Healy Drawing no. 1332 PL102 B).

The proposed scope of works is based on the findings of the desk study report for the site.

Site History

The site is an area of land comprising agricultural fields which have remained largely undeveloped.

Geology

The land is underlain by bedrock strata of the Pennine Lower Coal Measures Formation which comprise a sequence of interbedded sandstone, mudstone and siltstone. However, some made ground may be present in the eastern part of the site associated with a former colliery.

Mining

Shallow Workings

The site may have been subject to shallow mining of coal, which will require investigation and may require stabilisation works.

Mine Shafts

Records indicate that former mine shafts are located on or close to the site which will also require investigation and stabilisation.

The investigation for former mine shafts is usually carried out as a separate item following on from the site investigation.

The findings of the site investigation will inform the most appropriate investigation technique to try to locate the shafts, i.e. surface scrape or rotary probing.

A specification for the investigation of the mine shafts on the site will be issued on completion of the site investigation, costs will be dependent on the proposed investigation technique.

Contamination

Based on the site history, potential pollutant linkages may be present on the site and the site should be considered to be a moderate risk with respect to contamination. In order to fully assess and classify the risks to human health and environmental receptors chemical testing of soils and groundwater and gas monitoring is recommended.

Scope of Works

In order to assess the potential environmental and geotechnical constraints to the proposed development, the following scope of works is recommended below:

- Trial pitting in order to assess the shallow ground conditions at the site and confirm the composition, extent, depth and nature of the drift deposits and any made ground. It is proposed to excavate 11No trial pits.
- Cable percussion boreholes with in situ tests to provide geotechnical information in order to assess the nature of the sub-surface and confirm the depth and distribution of any made ground. It is proposed to drill 5No. boreholes with gas and groundwater monitoring wells.
- Rotary open hole boreholes (8No.) to investigate potential instability from past shallow mining – it is assumed that water flush will be required.
- Chemical analysis of soil and water samples in order to determine the concentrations of potential contamination on the site.
- Geotechnical testing to classify materials and inform foundation design and chemical testing to determine the Aggressive Chemical Environment for Concrete classification.

- Monitoring of gas and groundwater wells for hazardous gases, methane, carbon dioxide, and oxygen and flow rate to the requirements of the Local Authority.

At this stage no allowance has been made for the provision of overnight security or demobilisation of the drilling rig at the end of each shift.

Recommended Shaft Stand-Off

With respect to proposed the 'stand-off' from recorded shafts, I have attached the CA Shaft Records report which includes the recorded co-ordinates of the shafts.

I have spoken to the CA, they have informed me that there is an 8m departure distance from the recorded position of each shaft.

The no-build zone therefore extends for 8m (radius) from the recorded position of each shaft.

In addition, the no-build zone should be extended to include a line drawn up to the ground surface at 45 degrees from 'rockhead'.

Based on an estimate of 'rockhead' being located at 2m bgl, then a no-build zone of 10m from the centre of each shaft position would be appropriate.

Should you require any clarification of the above, please contact the undersigned.

Kind Regards

Reuben Mew – Associate



The footer contains the JPG Group logo on the left, followed by contact details for Leeds, London, and Birmingham, and the website address. To the right are two QMS ISO 9001 Registered logos and Acclaim Accreditation and Constructionline logos.

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	London:	0207 947 4148		
	Birmingham:	0121 222 4280	QMS ✓ ISO 9001 REGISTERED	
	Website:	www.jpg.group		

Constructionline
Member



All site dimensions shall be verified by the contractor on site prior to work commencing

Do not scale from this drawing
Only work to written dimensions

This drawing is the property of Ellis Healey Architecture and copyright is reserved by them. The drawing is not to be copied or disclosed by or to any unauthorised persons without the prior written consent of Ellis Healey Architecture.

NOTES

Site layout subject to detailed level and topographical review. Refer to engineers drawings for levels and details.
For landscaping details refer to landscape architects drawings and details.



SCHEDULE OF ACCOMODATION	
TYPE 2A - 2 BED SEMI-DETACHED - 680 SQ FT OFF STREET PARKING SPACES	27
TYPE 3A - 3 BED DETACHED - 905 SQ FT OFF STREET PARKING	24
TYPE 3B - 3 BED SEMI-DETACHED - 984 SQ FT OFF STREET PARKING	18
TYPE 3C - 3 BED DETACHED - 1,081 SQ FT DETACHED GARAGE	6
TYPE 3D - 3 BED DETACHED - 1137 SQ FT DETACHED GARAGE	4
TYPE 4A - 4 BED DETACHED - 1,162 SQ FT INTEGRAL GARAGE	5
TYPE 4B - 4 BED DETACHED - 1,318 SQ FT INTEGRAL GARAGE	1
TYPE 4C - 4 BED DETACHED - 1,382 SQ FT DETACHED GARAGE	13
TOTAL	98
NOTE: G.I.A. SHOWN EXCLUDING GARAGE SPACE	

SITE AREAS	
SITE AREA	8.90 ACRES (3.60 HA)
27.2 dwelling per hectare/ 11 dwellings per acre	
PUBLIC OPEN SPACE	0.36 HA
Bin store location	

Revision	Details of Revision	Date	By
Rev D	Updated to comments	13.06.19	(DPE)
Rev C	Updated to comments	11.06.19	(DPE)
Rev B	Updated to comments	28.05.19	(AFK)
Rev A	Updated to comments	24.05.19	(DPE)

ellis healey
architecture

SKETCH

PROJECT: PROPOSED DEVELOPMENT
LAND AT FERRAND LANE
GOMERSAL

TITLE: PROPOSED SITE PLAN

DRAWING NO: 1332 SK 19D

BY/CHECKED: DPE DATE: MAY 2019

SCALE @A3: 1:1250

100m Works, Gallop Road, Leeds, LS11 3JG
Tel: 0113 3432090 E-mail: info@ellishealey.com



The Coal
Authority

Issued by:

The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0345 762 6848 DX 716176 MANSFIELD 5

**JPG (LEEDS) LIMITED
BREMNER HOUSE
5 JOHN CHARLES WAY
LEEDS
WEST YORKSHIRE
LS12 6QA**

Our reference:	51001042792001
Your reference:	4730a
Date of your enquiry:	11 November 2015
Date we received your enquiry:	11 November 2015
Date of issue:	11 November 2015

This report is for the property described in the address below and the attached plan.

Shaft Plan and Data Sheets

FERRAND LANE, GOMERSAL, WEST YORKSHIRE,

I refer to the enquiry dated 11 November 2015, received 11 November 2015, in connection with the above.

As requested I enclose the mine entry data sheet(s) held for the mine entry/entries referred to.

Mine Entry Data

Shaft/adit:	Shaft
Reference:	420426-006
Source:	Ab plan 3921. 1st Ed. Geological.
Colliery name:	Unknown
Entry name:	Unknown
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	Unknown
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	420279
Northing:	426308
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Shaft
Reference:	420426-005
Source:	Ab plan 3921. 1st and 2nd Ed. Geological.
Colliery name:	Unknown
Entry name:	Unknown
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	27.9
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	Unknown
Conveyance:	Not Applicable
Easting:	420270
Northing:	426320
Other information:	None

Mine Entry Data (continued)

Shaft/adit:	Shaft
Reference:	420426-003
Source:	1st and 3rd Ed. 1/2500 O.S. 2nd Ed. Geological. Ab plans 4115 NE793
Colliery name:	Unknown
Entry name:	West Lane
Date abandoned:	Unknown
Depth of superficial deposits (m):	Unknown
Depth of shaft (m):	91.4
Diameter of shaft (m):	Unknown
Probable adit azimuth:	Not Applicable
Treatment details:	was searched for by drilling in 1983 but was not found. We have no record of what steps if any have been taken to treat this shaft
Conveyance:	Not Applicable
Easting:	420475
Northing:	426389
Other information:	None

Location map

Approximate position of enquiry



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This plan shows the approximate location of the disused mine entry / entries referred to in the attached mining report. For reasons of clarity, mine entry symbols may not be drawn to the same scale as the plan.

Property owners have the benefit of statutory protection (under the Coal Mining Subsidence Act 1991). This contains provision for the making good, to the reasonable satisfaction of the owner, of physical damage from disused coal mine workings including disused coal mine entries. A leaflet setting out the rights and obligations of either the Coal Authority or other responsible persons under the 1991 Act can be obtained by telephoning 0345 762 6848.

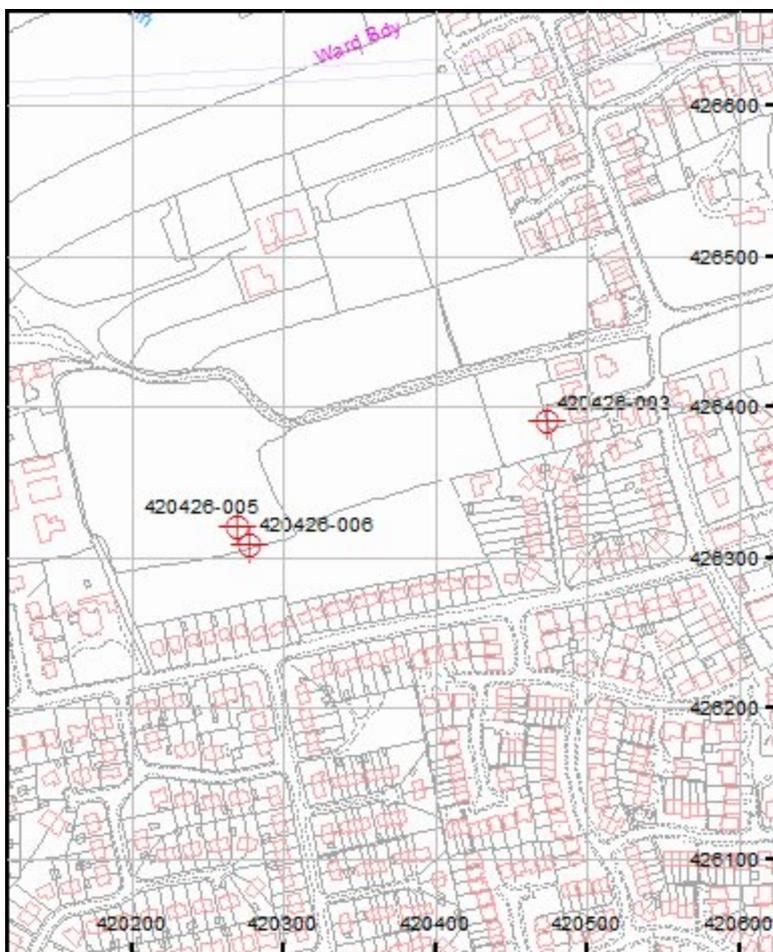
If you wish to discuss the relevance of any of the information contained in the attached report you should seek the advice of a qualified mining engineer or surveyor. If you or your advisor wish to examine the source plans from which the information has been taken these are available at our Mansfield office, free of charge by prior appointment, telephone 01623 637225. Should you or your advisor wish to carry out any physical investigations that may enter, disturb or interfere with any disused mine entry the prior permission of the owner must be sought. For coal mine entries the owner will normally be the Coal Authority.

The Coal Authority, regardless of responsibility and in conjunction with other public bodies, provide an emergency call out facility in coalfield areas to assess the public safety implications of mining features (including disused mine entries).

Our emergency telephone number at all times is 01623 646333.

Key

Disused Adit or Mineshaft



GEOPHYSICAL SURVEY REPORT

sumo

Survey

**GEOPHYSICS FOR
ARCHAEOLOGY &
ENGINEERING**



Cliffe Lane, Gomersal

Client
KCS Development Ltd

Survey Report
SOR15295A

Date
June 2019

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geophysics@sumoservices.com
www.sumoservices.com

GEOPHYSICAL SURVEY REPORT

Project name:
Cliffe Lane, Gomersal

SUMO Job reference:
SOR15295A

Client:
KCS Development Ltd

Survey date:
3rd & 4th June 2019

Report date:
19th June 2019

Field Team:
Andrew Bateman BSc MSc
Marek R Wajzer BSc PhD FGS

Report written by:
Marek R Wajzer BSc PhD FGS

CAD illustrations by:
Simon Haddrell BEng AMBCS PCIfA
Marek R Wajzer BSc PhD FGS

Project Manager:
Marek R Wajzer BSc PhD FGS

Report approved by:
Simon Haddrell BEng AMBCS PCIfA

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Appendix A Technical Information: Electromagnetic Method

Appendix B Technical Information: Magnetometer Survey Method

LIST OF FIGURES

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Figure 02	1:1000	Location of Geophysical Survey Area
Figure 03a	1:750	Ground Conductivity Contour Plan
Figure 03b	1:750	Magnetic Contour Plan

1 EXECUTIVE SUMMARY

A recent desk study identified a potential risk of two unmarked mineshafts on the Cliffe Lane Site in Gomersal, West Yorkshire. Combined electromagnetic (EM) and magnetic surveys were undertaken to search for evidence of the mineshafts.

The EM data was collected along a parallel series of 2 metre spaced, east-west oriented survey grid lines with readings taken at 2 metre intervals. The resulting ground conductivity data was contoured at intervals of 1 mS/m . The EM survey results are presented as a ground conductivity contour plan in Figure 3a.

The magnetometer data was collected along a parallel series of 1 metre spaced, east-west oriented survey grid lines with readings taken at 0.25 metre intervals. The magnetic data was contoured at graduated values between of $\pm 100 nT$, with the results presented as a colour scale plan in Figure 3b.

A conductivity anomaly and corresponding magnetic anomaly were identified close to one of the nominal mineshaft positions. The anomalies have been annotated on to the contour plans, for a possible follow up intrusive investigation. The other nominal mineshaft position was located close to the intersection of two densely vegetated hedgerows. No survey coverage was possible in the vicinity of this nominal position.

2 INTRODUCTION

2.1 Background synopsis

The Cliffe Lane site is scheduled to be developed as a housing estate. A recent desk study identified a potential risk of two unmarked mineshafts on the site. **SUMO Geophysics Ltd** were commissioned by Geodyne Ltd on behalf of the Client, to undertake a combined EM and magnetic geophysical survey to search for evidence of the mineshafts.

2.2 Site details

NGR / Postcode	SE 20292632 / BD19 4SE
Location	The geophysical investigations were carried out on the Cliffe Lane site in Gomersal
District	Cleckheaton, West Yorkshire
Topography	A sloping grassed field with intersecting hedgerows
Current Land Use	Pasture
Geology	Sandstone units from the Pennine Middle Coal Measures Formation (BGS 2019)
Superficials	None recorded
Survey Methods	Electromagnetic survey (ground conductivity meter) Magnetometer survey (fluxgate gradiometer)

2.3 Aims and Objectives

To search for evidence of hidden mineshafts

3 METHODS, PROCESSING & PRESENTATION

3.1 Survey Methods

Both the electromagnetic and magnetic surveys were used as efficient and effective methods for detecting hidden mineshafts.

3.2 Survey Equipment

Technique	Instrument	Traverse Interval	Sample Interval
Electromagnetic (EM)	Geonics EM 31	2.0m	2.0m
Magnetometer	Bartington Grad 601-2	1.0m	0.25m

3.3 Survey Procedure

The survey area was set up using a series of grid points defined Geodyne, which encompassed the two nominal mineshaft positions (MS5 and MS6) within 25 metre squares. The grid point positions are presented in Figure 2, together with the nominal mineshaft positions.

The EM survey was carried out in combination with a handheld Allegro field computer. The system was set-up to record the ground conductivity and in-phase components of the secondary electromagnetic field. A base station was set up in a quiet part of the site to monitor instrument drift. The electromagnetic data was collected along a parallel series of north-south oriented survey grid lines, spaced at 2 metre intervals. The EM 31 boom was oriented perpendicular to the survey lines, with the coils in vertical mode. Individual data readings were taken at 2 metre intervals along each survey line. The cover page shows the EM survey in progress. More information regarding the electromagnetic techniques is given in Appendix A.

The Bartington Grad 601-2 operates with an inbuilt data logger. The magnetic data was collected over the same area as the electromagnetic data along 1 metre spaced survey grid lines, with readings taken at 0.25-metre intervals. A base station was set up for the magnetometer survey in a quiet part of the site, for monitoring instrument drift. More information regarding the magnetic method is given in Appendix B.

No survey coverage was possible within the vicinity of the fences and hedgerows that transect the site, nor in a number of clumps of dense, high vegetation fringing the hedgerows. It was not possible to acquire any data over one of the nominal mineshaft positions (MS6), which was located in the middle of a hedgerow.

3.4 Data Processing & Presentation

3.41 Electromagnetic Data

The conductivity data was contoured using Surfer contouring software at an interval of 1 mS/m . The final results are presented as a contour plan in Figure 3a. The colouring scheme shows the background in pale yellow, green and pale blue. Low conductivity values are highlighted in darker blue and higher conductivity values are displayed as darker shades of pink and red.

3.42 Magnetic Data

The magnetic data was initially de-striped by the zero mean process to set the background mean of each profile to zero, in order to remove striping effects and edge discontinuities. The next stage of processing involved step correction to de-stagger the data. The processed data is presented as a colour scale plot in Fig. 3b. Background levels of magnetism between the ranges of -3 to +3 nT appear in greyscale. Higher field values above this range are presented

as shades of yellow, orange and red. Magnetic field values that fall below background levels are presented as various shades of blue.

4 INTERPRETATION OF RESULTS

4.1 Electromagnetic Data

Changes in ground conductivity are often associated with lithological changes. An abandoned shaft infilled with material of different composition to surrounding in-situ ground, may produce an anomaly. If the infill has similar electrical properties to the in-situ ground, then an anomaly may not be produced. On a conductivity contour plan a mineshaft may appear as a small, discrete, high or low conductivity anomaly that stands out from the surrounding background. However, anomalies of this type are not unique to mineshafts and could be produced by other features such as backfilled excavations or discrete changes in ground composition.

The presence of metal in the ground modifies the signal response. Generally very high positive and all negative conductivity anomalies are produced by induction effects associated with surface or buried metal. The magnitude and polarity of the metal induced anomalies are polarisation sensitive and depend on the orientation of the EM 31 booms relative to the targets, and the shapes and depths of the targets. Some spurious anomalies can be eliminated by careful correlation with features visible on the ground surface.

4.2 Magnetic Data

The magnetic method is highly sensitive to ferrous metal. It also reacts to the presence of soils, rocks and artefacts containing weakly magnetic minerals. Magnetic anomalies should be produced by a near surface mine shaft cap containing iron or steel elements, or by scrap metal dumped into the upper levels of a mineshaft. Similar to the electromagnetic method, these types of anomalies are not unique to mineshafts. The presence of near surface scrap metal, metal pipes or reinforced concrete are likely to obscure the response from any mineshafts in the vicinity of the metal

It is important to note that the shape of discrete anomalies defined by contouring, does not usually match the true physical shapes of the features producing the anomalies and can occasionally be misleading.

5 SUMMARY OF RESULTS

The results of the Cliffe Lane Site in Gomersal are presented as a ground conductivity contour plan in Figure 3a and a magnetic colourscale plot in Figure 3b. The positions of the survey grid points are presented in Figure 2.

It is estimated that the maximum depth range of the electromagnetic survey was roughly 4 - 5 metres below ground level (bgl) and the magnetic survey had a maximum depth range of approximately 1.5 - 2.0 metres bgl.

The lowest conductivity values occur in the north-west corner of the site (12 – 15 *mS/m*). The background conductivity increases in a general south-eastward direction, reaching values of 22 – 25 *mS/m* in the south-east corner. This trend broadly matches an increase in elevation in the same direction. In the absence of any correlation data at this stage of the programme, it is suggested that the variations in background conductivity are likely to be associated with lithological changes in the bedrock.

The conductivity contour plan has a weak but discrete, circular, high conductivity anomaly **C1** in the middle of the site area. A corresponding circular magnetic high **M1** is present at the same position on the magnetic contour plan. The combined conductivity/magnetic anomalies coincide with one of the nominal mineshaft positions (MS5), suggesting they could be associated with a hidden mineshaft. It is recommended that the combined **C1/M1** anomaly is targeted for further investigations. The other electromagnetic anomalies on the site are likely to be produced by surface metal features and have been annotated on the plans with an **S**,

On the magnetic contour plan, the diffuse linear and irregularly curved features are associated with background variations in the magnetic field. The odd small, discrete vaguely circular blobs scattered around the site are probably caused by small fragments of ferrous material.

No other obvious conductivity or magnetic anomalies suggestive of mineshafts were detected in the area investigated. However, there was no data coverage over the other nominal mineshaft position at MS6. Given the apparent accuracy of the mineshaft position at MS5, it is reasonable to assume that the other mineshaft is likely to be close to MS6.

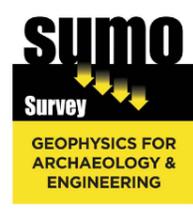
6 CONCLUSION

A combined electromagnetic and magnetic geophysical survey of the Cliffe Lane site identified a combined ground conductivity **C1** and magnetic anomaly **M1** close to one of the nominal mineshaft positions. The combined anomaly has been annotated on to the contour plans for possible follow up intrusive investigations. The other nominal mineshaft position was located close to the intersection of two densely vegetated hedgerows, where no survey coverage was possible. There was no clear evidence of any other anomalies potentially corresponding to mineshafts in the survey area.



● Site Location

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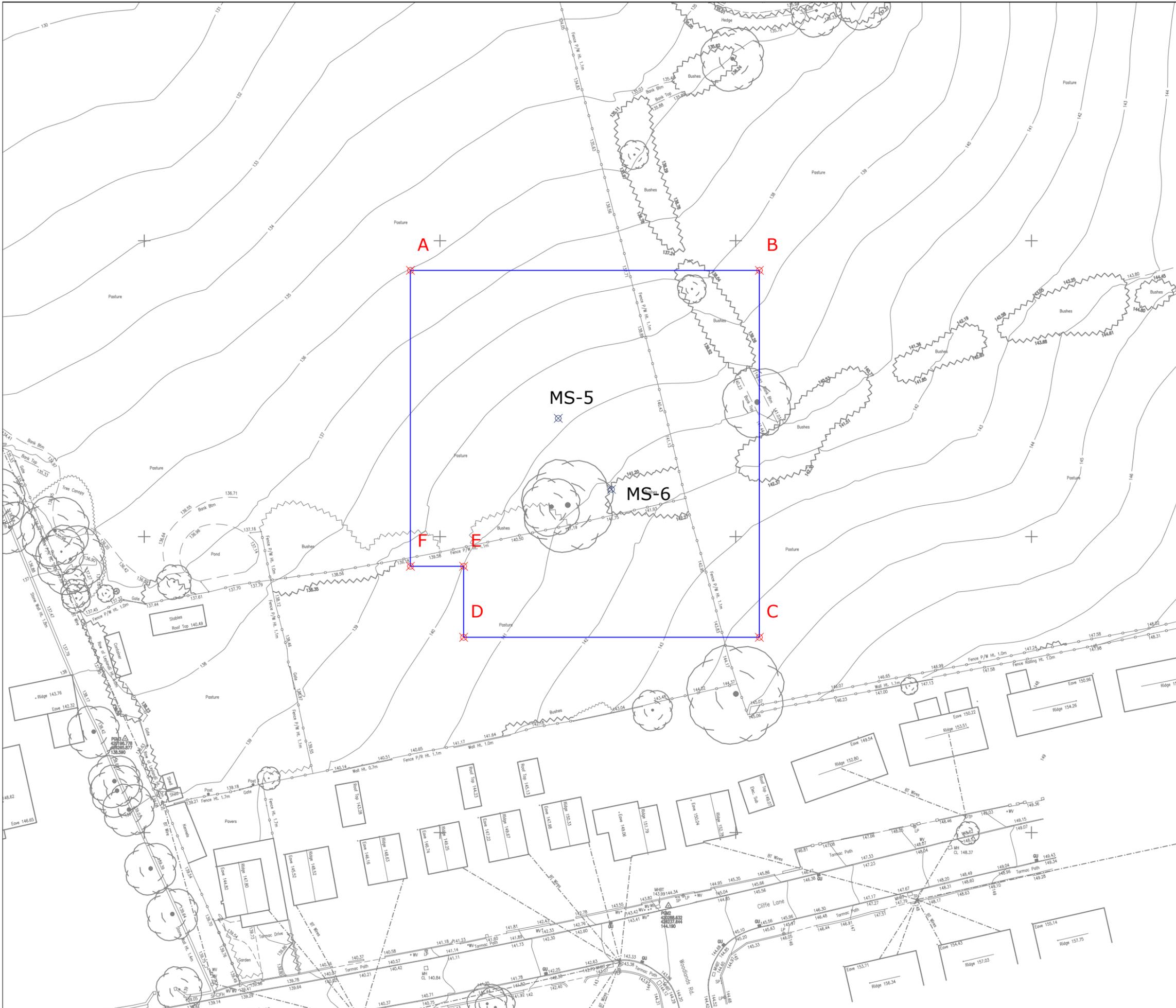
Title: SITE LOCATION DIAGRAM

Client: KCS Development Ltd

Project: SOR15295 Cliffe Lane, Gomersal

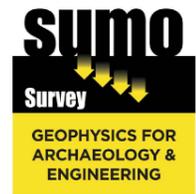
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Fig No: 01



REFERENCING

A	420245,426345
B	420304,426345
C	420304,426283
D	420254,426283
E	420254,426295
F	420245,426295
MS 5	420270,426320
MS 6	420279,426308



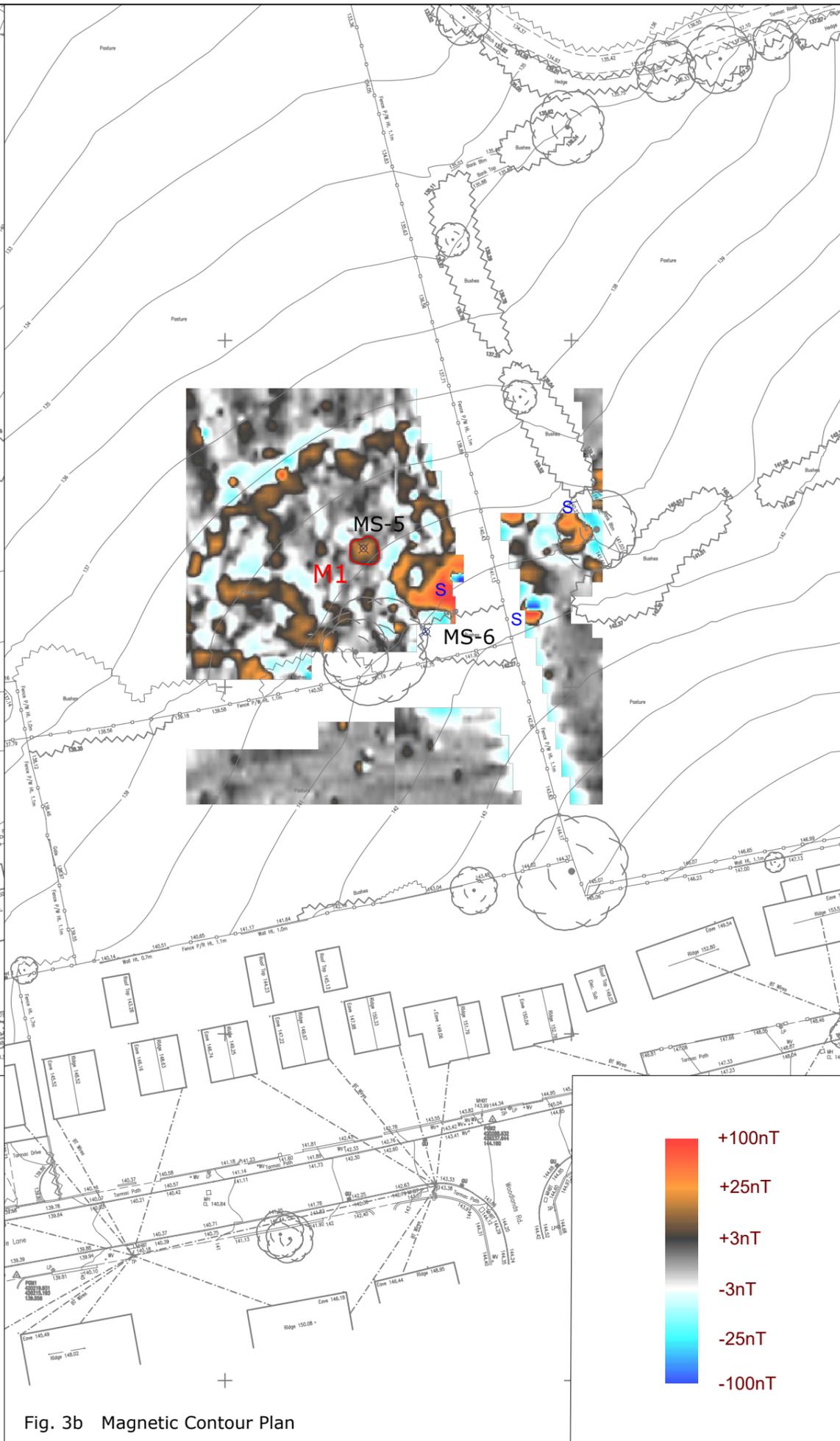
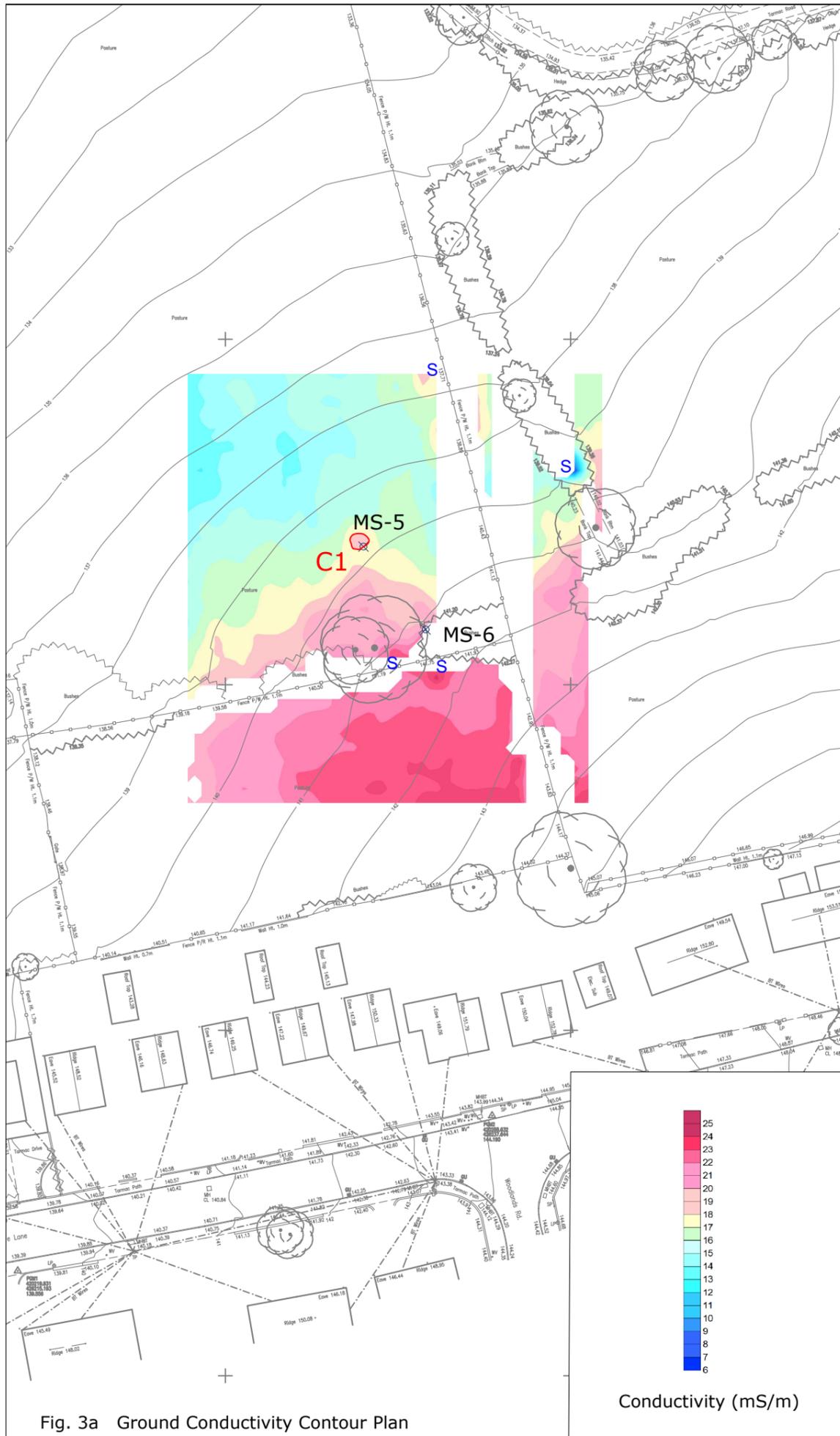
Title: SURVEY AREA, GRID POINTS & NOMINAL MINESHAFT LOCATIONS

Client: KCS Development Ltd

Project: SOR15295 Cliffe Lane, Gomersal

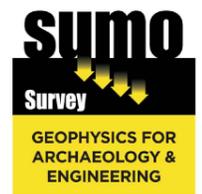
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Fig No: 02



KEY

S	SURFACE METAL ANOMALY
C1	CONDUCTIVITY ANOMALY
M1	MAGNETIC ANOMALY



Title: CONTOUR PLANS

Client: KCS Development Ltd

Project: SOR15295 Cliffe Lane, Gomersal

Scale: 0 metres 32.5
1:750 @ A3

Fig No: 03

APPENDIX A – ELECTROMAGNETIC EM 31 METHOD

The Geonics EM 31 measures the electrical conductivity of the ground by inducing an electromagnetic field. The device consists of two vertical co-axial coils mounted on a boom that maintains a constant inter-coil spacing of 3.66 metres. One coil transmits a continuous electromagnetic wave at a frequency of 9.8 KHz, which induces secondary electromagnetic fields in the ground. The other coil acts as a receiver measuring the response of the ground to the induced fields (Plate. 1).

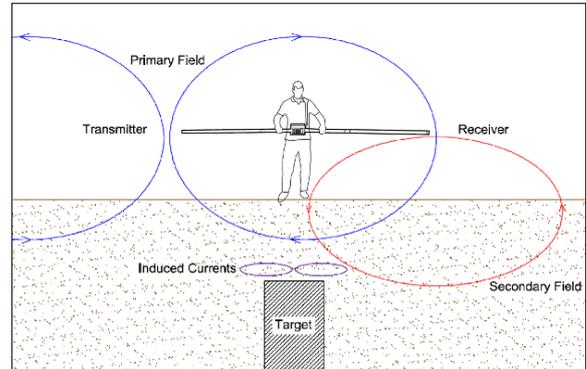


Plate 1 Schematic diagram of an EM31 survey over a target, showing the primary and secondary electromagnetic fields

The receiving coil measures the ratio between the primary and secondary fields, called the in-phase component which is measured in parts per thousand (*ppt*). The receiving coil also measures the magnitude of the secondary field. This is termed the quadrature phase component, measured in milliSiemens per metre (*mS/m*). In-phase fields tend to provide the best response for locating buried metal targets, whereas quadrature fields are directly proportional to the bulk conductivity of the ground.

The measured ground conductivity approximates to an average conductivity value of the ground, over a depth range of 4 - 5 metres from the ground surface. This depth range is only approximate, and depth penetrations decrease significantly in areas where near surface ground conductivities are high. Lateral variations in ground conductivity are measured by taking a series of equidistant readings along a network of survey lines. Typical survey procedures involve taking point readings at regular intervals along survey lines arranged in a grid pattern across the site area. The line spacing will depend on the size of targets that are being investigated, with smaller targets requiring denser survey grids.

Reading values of apparent ground conductivity and the in-phase component are input into a data logger or field computer. The raw data is downloaded on to a standard PC for post-survey processing, contouring and plotting. Various interpretation techniques are applied to the contoured data to identify the targeted anomalies.

Factors which effect ground conductivity include voids, porosity, moisture, clay content, subsurface leachate and other contaminants. Results are likely to be poor if there is a significant amount of surface metal present on a site such as fences, pylons, manholes, scrap metal, etc. The high conductivities and conductivity gradients produced by the presence of surface and near surface metal tend to obscure anomalous ground conductivity values by masking the background values.

It should be understood that the interpretation of all geophysical data are opinions based on inferences from electromagnetic measurements, factors and assumptions, and that such inferences are not infallible. For the foregoing reasons and because of the uncertainty of variable ground conditions, it is not possible to guarantee the accuracy of any interpretation. Such interpretation should not be relied upon as the sole basis for construction or financial decision.

APPENDIX B – MAGNETIC METHOD

Detailed magnetic surveys can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic surveys are carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same. The fluxgate gradiometer also suppresses any diurnal or regional effects.

The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m.

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.



Project No.	39175	Drawn By	ACH
Client	KCS Development Ltd	Checked By	TM
		Approved By	DH
Project	Cliffe Lane, Gomersal	Scale	NTS
		Date Drawn	08/07/2019
Title	Views of GPS Positions of Coal Authority Indicated Mine Shafts	Revision	
		Figure No.	39175/GS/P1



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View looking across eastern part of survey area



View of metallic discarded trailer



Project No.	39175	Drawn By	ACH
Client	KCS Development Ltd	Checked By	TM
		Approved By	DH
Project	Cliffe Lane, Gomersal	Scale	NTS
		Date Drawn	08/07/2019
Title	General Views of Area Surveyed by Sumo Geophysics	Revision	
		Figure No.	39175/GS/P2



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Views looking across western part of geophysical survey area



Project No.	39175	Drawn By	ACH
Client	KCS Development Ltd	Checked By	TM
		Approved By	DH
Project	Cliffe Lane, Gomersal	Scale	NTS
		Date Drawn	08/07/2019
Title	General Views of Area Surveyed by Sumo Geophysics	Revision	
		Figure No.	39175/GS/P3



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Conditions & Limitations

Phase I Desk Studies

1. Works undertaken to provide the basis of the Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. GeoDyne Limited assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.
2. Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, GeoDyne Limited reserves the right to review such information and make modifications to comments/opinions as appropriate.
3. It should be borne in mind that a Phase I Desk Study collates available information to generate a conceptual model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the conceptual site model.

Phase II Intrusive Investigations

1. Our quotation assumes that access to the site will be arranged by others at no cost to ourselves.
2. We have assumed that free access is available throughout to the entire site and that works can be undertaken during a single mobilisation. Where restricted access is encountered, or where additional unscheduled mobilisations are required, additional costs may be incurred to the client.
3. We have assumed that all available information relating to buried services will be supplied by the Client at no cost to ourselves. No responsibility will be accepted for damage to underground services that have not been brought to our prior attention by the Client.
4. All excavations/boreholes will be backfilled with compacted arisings upon completion, with any excess arisings left proud of ground levels. Excess arisings will not be removed from the site unless specifically requested by the Client. Where we are requested to remove excess arisings, all associated costs will be passed to the Client.
5. We will attempt to leave the site in a clean and tidy state, however, it must be understood that some disturbance of the site is unavoidable during intrusive works.
6. Exploratory holes are positioned approximately on site by GeoDyne Limited. Should the client require precise locations of all exploratory points, additional fees will be incurred. It must be borne in mind that backfilled trial pits can create 'soft spots', therefore, should the Client wish to designate 'no dig' zones, for example under the footprint of proposed structures, these must be brought to our attention prior to commencement of works.
7. Groundwater observations relate to conditions encountered at the time of investigation. It must be understood that groundwater levels may vary as a result of recent climatic conditions or seasonal variation.
8. Trial pits and boreholes examine only a small proportion of the total site area. No liability can be accepted for conditions not revealed in exploratory holes, particularly between positions. All extrapolations of available data are given in good faith.

Payment

1. Payment terms are strictly 28 days from the invoice date.
2. Prior to commencement of works, we require receipt of formal written instruction from the party accepting full financial responsibility for the work. In the absence of such an instruction, we would expect the instructing Consulting Engineers/Architects to accept full financial responsibility for the works.
3. Receipt of instruction to commence work shall be taken as acceptance and compliance of the foregoing conditions.

Liability

1. GeoDyne Limited offer £5,000,000.00 Professional Indemnity Insurance (in aggregate over the year). This shall be the limit of our liability for works undertaken. No individual liability shall be implied to, or accepted by, any employee for works undertaken for and on the behalf of GeoDyne Limited.